Transmission of genetic diversity during natural regeneration of pedunculate oak (*Quercus robur*) pleas for customized regeneration management in small forest stands

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Abstract

Natural regeneration is currently considered as the most suitable regeneration method in sustainable forestry, both from an ecological and an evolutionary point of view. However the benefits of natural regeneration may be jeopardized in small sized forest stands, as processes such as genetic drift, increased inbreeding or specific forestry activities that precede natural regeneration events can have a major impact on how genes are transferred from the parental generation to the progeny. Nevertheless, small forests stands have become common in many parts of Western Europe, mainly as a consequence of past deforestation and fragmented forest ownership. Also the recent tendency towards a more close-to-nature forests management has led to a more fine-grained forest landscape with smaller monospecific patches. As a result, a better understanding of the genetic consequences of natural regeneration in small forest stands is hardly needed. In this study we examined mating and gene flow patterns in four small (< 4.5ha), naturally regenerating pedunculate oak stands (*Quercus robur)* and investigated their role in shaping stand genetic diversity and spatial genetic structure (SGS) among different life-history stages. We found that acorn dispersal resulting in seedling recruitment was restricted to a few meters entailing a significant SGS in the offspring, whereas no significant SGS was observed for the adult trees. Pollen inflow from outside our study plots varied strongly among stands (32%-74%), however all studied stands showed a significant correlated paternity. The smallest stand showed a significantly higher correlation of paternity, and thus lower estimated number of pollen donors, per mother tree than the other stands. Large inter-tree distances also affected the pollen pool of the medium-sized stand, in which a greater proportion of seedlings were sired by local pollen donors, and pollen immigration rates were much more restricted than those of the higher density stands. This study demonstrates that although natural regeneration may be recommendable in large stands, small-scale silvicultural systems require more customized management practices to maximize the transfer of genetic variation across generations

Keywords : intergenerational transmission of genetic diversity, natural regeneration, small-scale forestry